Diversions

Definition: A diversion consists of a channel or ridge, or a combination channel and ridge, constructed across sloping land either on the contour or at a predetermined grade. This practice diverts water from areas where it is in excess to sites where it can be used or disposed of safely. By diverting runoff, erosion damage to cut and fill slopes, construction sites, and other erodible areas is significantly reduced. Some flood protection for low- lying residences, businesses, parks, and other improvements may also be provided. Diversions are of two types, permanent and temporary.

Permanent diversions are those which will remain a part of the landscape and be maintained for the life of the practice.

Temporary diversions are installed to prevent serious erosion until other permanent measures can be installed. The life of a temporary diversion is usually less than one year.

Purpose: To divert excess water from one area for use or safe disposal in other areas.

Conditions where Practice Applies: This practice applies to sites where:

1. Runoff damages urban areas and areas under construction.
2. Runoff is in excess and may be used or controlled by diverting to other sites.
3. An erosion and sediment control plan requires diversions as part of the pollution abatement scheme.
4. The length of slope should be reduced so that soil loss will not be excessive for the planned land use and treatment
5. Land slope is 20 percent or less, and slippage is not a problem.

Effects on Water Quantity and Quality

A diversion may increase the opportunity for surface water to infiltrate into the soil. This will be on a small percentage of the watershed. A diversion diverts surface water away from the area downslope from itself, reducing the opportunity for the water to infiltrate into the soil in this area. This is a much larger percentage of the watershed. The net effect may be the decrease in the amount of water infiltrating into the soil. Diversions may change the location in which surface water may flow, but they may have little effect on the quantity of surface or ground water.

This practice will assist in the stabilization of a watershed, resulting in the reduction of sheet and rill erosion by reducing the length of slope. Sediment may be reduced by the elimination of ephemeral and large gullies. This may reduce the amount of sediment and related pollutants delivered to the surface waters.

This practice diverts surface runoff away from particular areas and prevents the incorporation of any pollutants within these areas into the runoff and the transport of these pollutants to the receiving waters.

Design Criteria

Capacity: Diversions as temporary measures, with a life span of 1 year or less, shall carry as a minimum the 2-year, 24-

hour duration storm. Diversions that are part of an erosion and sediment control system designed to last more than 1 year must have the capacity to carry the peak runoff from a 10-year frequency, 24-hour duration storm as a minimum.

Permanent diversions designed to protect urban areas, buildings, and improved roads, shall have enough capacity to carry the peak runoff expected from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm with a freeboard not less than 0.3 ft.

Cross section: The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes. The ridge height shall include an adequate settlement factor. The ridge shall have a minimum top width of 4 feet at the design elevation. The minimum cross section shall meet the specified dimensions. The top of the constructed ridge shall not be lower at any point than the design elevation plus the specified overfill for settlement.

Grade and velocity: Channel grades may be uniform or variable. Channel velocity shall not exceed the velocity shown in Table 1.

Location: The location of the diversion shall be determined by outlet conditions, topography, cultural operations, and soil type.

Protection against sedimentation: Diversions should not be used below high-sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversions. If movement of sediment into the channel is a significant problem, a vegetated filter strip shall be used where soil or climate does not preclude its use. Then, the design shall include extra capacity for sediment and be supported by supplemental structures, cultural or tillage practices, or special maintenance measures.

Outlets: Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable water-course, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed before diversion construction to insure establishment of vegetative cover in the outlet channel.

Underground outlets consist of an inlet and underground conduit. The release rate when combined with storage is to be such that the design storm will not overtop the diversion ridge.

The design elevation of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation: Disturbed areas that are not to be cultivated shall be established to grass as soon as practicable after construction. If the soils or climatic conditions preclude the use of vegetation for erosion protection, nonvegetative linings such as

gravel, rock rip-rap, or cellular block may be used. Seedbed preparation, seeding, fertilizing, and mulching shall comply with standards in the vegetation measures section of this handbook.

Operation and Maintenance

A maintenance program shall be established to maintain diversion capacity, storage, ridge height, and the outlets. Maintenance needs are to be discussed in the erosion and sediment control plan. As a minimum, the diversion must be inspected and repaired as necessary after every storm event that causes flow in the diversion. Any hazards must be brought to the attention of the responsible person.

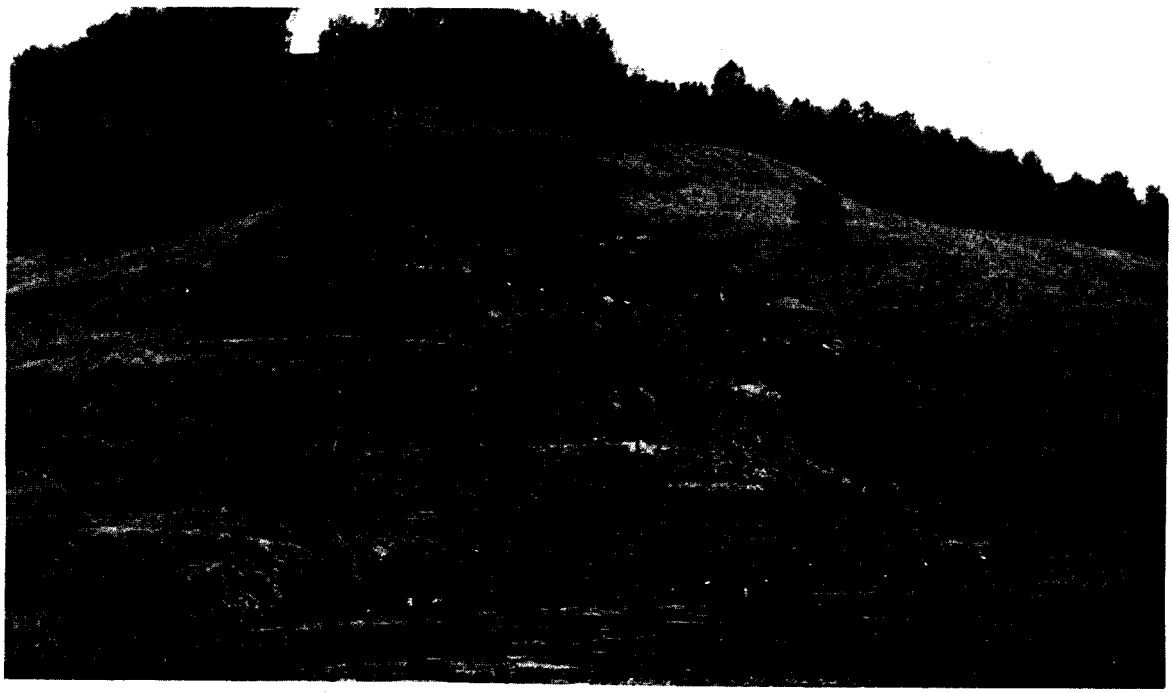
Plans and Specifications

Plans and specifications for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. See construction specification guide that follows.

Design Aids

Appendix B may be used for estimating the runoff expected from a drainage area. Other guides which may be used include Chapter 2 of the Soil Conservation Service Engineering Field Handbook and SCS Technical Release 55.

The design for capacity and stability may be calculated by Manning's equation by taking into consideration the degrees of retardance of various vegetal covers. Designs will normally be based on retardance "D" for stability and permissible velocity and retardance "C" for capacity (top width and depth). Design procedures are outlined in detail in Chapter 9, Engineering Field Handbook.



A series of temporary diversions are installed on a disturbed, steep slope to protect it from erosion until vegetation is established.

Table 1 — Permissible velocities for diversions.

Soil Texture	Bare Channel	Retardance	Channel Poor	Vegetation Fair	Condition Good
	Permissible Velocity				
	ft/s		ft/s		
Sand, silt, sandy loam, & silty loam	1.5	B	2.0	3.0	4.0
		C	1.5	2.5	3.5
		D	1.5	2.0	3.0
Silty clay loam & sandy clay loam	2.0	B	3.0	4.0	5.0
		C	2.5	3.5	4.5
		D	2.0	3.0	4.0
Clay	2.5	B	3.5	5.0	6.0
		C	3.0	4.5	5.5
		D	2.5	4.0	5.0
Coarse gravel	5.0	B, C, or D	5.0	6.0	7.0
Cobbles & shale	6.0	B, C, or D	6.0	7.0	8.0

Table 2 — Guide to selection of vegetal retardance.

Stand	Average length of vegetation	Degree of retardance	Stand	Average length of vegetation	Degree of retardance
	in			in	
Good	Longer than 30	A	Fair	Longer than 30	B
	11 to 24	B		11 to 24	C
	6 to 10	C		6 to 10	D
	2 to 6	D		2 to 6	D
	Less than 2	E		Less than 2	E

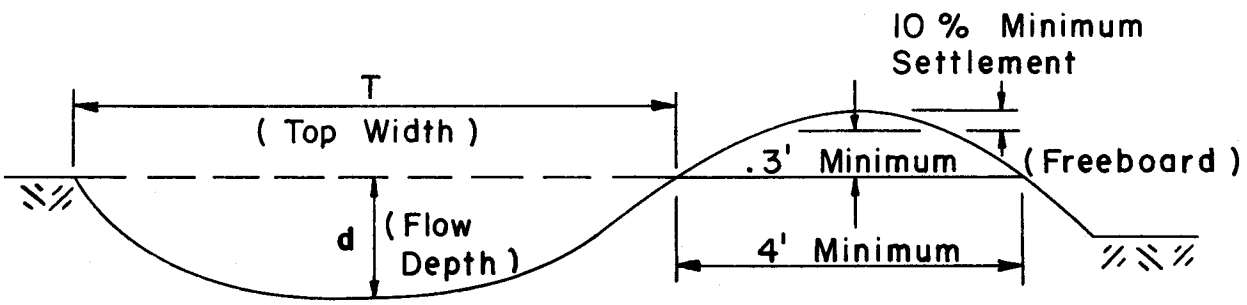


Figure 5 — Typical cross section of parabolic diversion

Specifications

Preparation of sites for diversion construction shall be done in a manner which destroys as little vegetation outside the areas to be occupied by the diversion as feasible. Special efforts shall be made to save trees of significant value.

Construction operations shall be carried out in a manner to minimize air and water pollution and hold such pollution within legal limits. Bare areas shall be vegetated as soon as practical after earthwork is completed.

Disposal of debris from site preparation shall be done in a manner as to cause minimum pollution to the environment.

All ditches or gullies to be crossed shall be filled before construction begins or as a part of construction. Fence rows or other obstructions that will interfere with the successful operation of the diversion shall be removed.

The earth materials used in constructing the earthfill portions of the diversions shall be obtained from the diversion channel or other approved sources.

The earthfill materials used to construct diversions shall be compacted by routing the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment.

When an excess of earth material results from cutting the channel cross section and grade, it shall be deposited adjacent to the supporting ridge or other approved area.

The completed diversion shall conform to the cross section, line, and grade shown on the design.

All sections of the channel shall be free-draining. Low spots shall not exceed 0.2 foot in depth, nor extend for more than 50 feet. No low spots are permissible on soils subject to slippage. All portions of the diversion shall be finished in such a manner that vegetative cover can be established.

A permanent diversion was constructed to protect a school from runoff.